Downloaded from orbit.dtu.dk on: May 04, 2023

DTU Library

Implementation of Auctions for Renewable Energy Support in the Netherlands and Denmark: A cooperation case study

Report D7.1-NL/DK, March 2016

Gephart, Malte; Kitzing, Lena; Tiedeman, Silvana; Wigan, Fabian; Klessmann, Corinna; Noothout, Paul

Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Gephart, M., Kitzing, L., Tiedeman, S., Wigan, F., Klessmann, C., & Noothout, P. (2016). *Implementation of Auctions for Renewable Energy Support in the Netherlands and Denmark: A cooperation case study: Report D7.1-NL/DK, March 2016*. Technical University of Denmark.

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Report D7.1-NL/DK, March 2016

Implementation of Auctions for Renewable Energy Support in the Netherlands and Denmark: A cooperation case study

Short about the project

Auctions for Renewable Energy Support: Effective use and efficient implementation options (AURES)

This project helps assessing the applicability of different auction types to renewable support under different market conditions. It also explores which auction types and design specifications suit particular requirements and policy goals in European countries. By establishing best practices and a knowledge sharing network, we contribute to informed policy decision-making and to the success of auction implementations across Europe.

Target-oriented analysis: Through analysis of empirical experiences, experiments and simulation, we will create a flexible policy support tool that supports policy makers in deciding on the applicability of auction types and certain design specifications for their specific situation.

Capacity building activities: We undertake specific implementation cases to derive best practices and trigger knowledge sharing amongst Member States. We strive to create a strong network with workshops, webinars, bilateral meetings, newsletters, a website that will serve as capacity building platform for both policy makers and market participants (including project developers, auctioneers, etc.). Wherever required, we can set up specific bilateral and multilateral meetings on specific auction issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals.

Project consortium: eight renowned public institutions and private firms from five European countries and combines some of the leading energy policy experts in Europe, with an impressive track record of successful research and coordination projects.

This report deals with the potential implementation of opened auctions for Renewable Energy support in the Netherlands from 2017 on. The report focuses on the implementation process and provides the necessary background information. Furthermore the planned auction design is described and discussed both from a policy maker's and an investor's point of view. Finally, main strengths and weaknesses are identified and the scheme is discussed according to several success criteria. The proposed design is related to the findings from AURES work packages 2, 3 and 4, which included the identification of success criteria, of appropriate auction formats and suitable design elements for RES auctions, as well as the analysis of past auction implementations.

This report forms part of AURES Deliverable 7.1, which is presented in six separately paginated parts:

D7.1-INTRO	Introduction to the task 7.1 case studies: case selection and methodology
D7.1-ES	Case 1: Spain
D7.1-PL	Case 2: Poland
D7.1-SK	Case 3: Slovakia
D7.1-HR	Case 4: Croatia
D7.1-NL/DK	Case 5: Netherlands – Denmark cooperation

The report contributes to the first of three tasks in work package 7 of the AURES project:

T7.1 Identifying future implementation plans for auctions in Europe
T7.2 Performing specific implementation cases of future auction implementation
T7.3 Model based analysis of the specific cases

Report D7.1-NL/DK, March 2016

Implementation of Auctions for Renewable Energy Support in in the Netherlands and Denmark: a Cooperation Case Study

Authors: Malte Gephart (Ecofys), Lena Kitzing (DTU)

With contributions from: Silvana Tiedemann, Fabian Wigand, Corinna Klessmann, Paul Noothout (Ecofys)

Project deliverable:
WP7 – Future implementation possibilities for auctions in Europe.
Task 7.1 specific implementation cases

AURES: a coordination and support action of the EU Horizon 2020 program, grant number 646172

Table of contents

1 Introduction[1]

Usually auctions for RES support are organised nationally, i.e. by public entities and for RES installations that are located within the national territory. This report explores how auctions for RES support can be opened for installations from other countries. This would imply that RES projects from one country could participate in an auction scheme of another country and receive the related subsidies from that country. There are several reasons why auctions might be opened: First, from an economic perspective an opened auction can result in increased (static) efficiency of the auctions because cheaper sites in other countries can be used, for instance for RES target achievement of the respective country. Second, the European Commission at several occasions has interpreted levy-financed support schemes as being very similar to an import tax (because only installations on that territory can access the support scheme). To address this charge, several Member States (MS) are actively exploring the option of opening their support schemes. Third, opening national support schemes would be a crucial step to effectively drive cross-border participation forward, potentially on a regional level and to foster the coordination and convergence of European energy policies (in this case of support schemes).

Two basic options of opened auctions are the unilaterally opened auction (one country opens its auction for projects from abroad) or the joint auction (two or more countries jointly implement one auction scheme). This report focuses on a unilaterally opened auction and specifically on the auction design aspects rather than on the cooperation aspects (which are not in the focus of the AURES project).

The cases we will explore in this study are the Netherlands (NL) and Denmark (DK). NL have introduced a technology-neutral auction in 2011, the SDE+, and we will explore options to open this auction scheme for onshore wind installations from DK. The SDE+ could in principle be open to installations from any MS, but as we will see, the opening might have to be adapted to specific conditions in the cooperating country, which is why we focus on one cooperating country.

The combination of NL and DK is promising as NL has a low RES share (4.8% in 2013 and 5.6% in 2014), but has difficulties in meeting its 2020 targets cost-effectively. In contrast, DK has a very high RES-E share (43.5% in 2014), but in addition still has great onshore wind potential and more available sites than NL (in comparison to inhabitants and/or electricity consumption).[2] We focus on onshore wind as the potential in DK is very good (if compared to PV for instance) and project size and lead times are less complex than for offshore wind parks.

In this report we will first describe the basic market conditions in NL and DK, as this is the background against which the auction should ideally be designed (chapter 2). This is followed by a detailed exploration of the potential design of the opened auction (chapter 3). We will describe the current design of the Dutch support scheme SDE+ and then discuss whether and how the specific design element might have to be adapted if

[1] This report includes information based on interviews with representatives of the Dutch Ministry of Economy, ECN and the Danish Energy Agency. However, none of the opinions and positions expressed in this report represent the official positions of the respective entities in NL or DK.

[2] Also the Danish TSO Energinet.dk has recently stated that another 13GW of onshore wind energy can be installed until 2030 at socio-economic cost lower than offshore wind. Energinet.dk (2015): Analyse af potentialet for landvind i Danmark i 2030, available at: https://www.energinet.dk/SiteCollectionDocuments/Danske%20dokumenter/Klimaogmiljo/Potentialet%20for%20landvind%20i%20Danmark%20i%202030.pdf.

installations from DK were eligible for support under this scheme. In the following chapter we will address possible reservations against opening the SDE+ (chapter 4). In chapter 5 we will briefly estimate the expected performance of the opened SDE+ along the lines of several assessment criteria (e.g. effectiveness and efficiency). In the conclusion we wrap up the main findings and argue that there are several technical details to be further explored, but the opening can be implemented and be beneficial to the Dutch consumers as well as for Dutch and Danish project developers.

It is important to note that this case study is hypothetical and the options discussed here do not necessarily reflect the Dutch or Danish preferences and positions.

2 Description of market conditions and RES auction status

Country and market characteristics in the Netherlands

NL has a population of roughly 17 million people and an annual electricity consumption of about 102 TWh (almost 4% of EU-28) and it is well integrated in the European electricity system.

NL has a binding EU target for Renewable Energy of 14% in 2020. Although progress has been slow historically, deployment speed is picking up: in 2013 the share was 4.8%, rising to 5.6% in 2014[3]. This has been strengthened by an agreement in 2013 between all relevant stakeholders to meet the target and on the measures that are needed (Energy Agreement).

However, according to the latest prognoses of the national energy statistics, NL will not meet its RES target with current and proposed measures, reaching 11-13% RES share in final consumption, thereby falling 1-3%-age points short of their 14% target.

[3] Some 0.5 percent point of the 0.8 percent point increase of 2014 on 2013 is due to a decrease in total final energy consumption and the rest to an increase in renewable energy consumption. Consumption was lower because less natural gas was consumed due to the warm weather in 2014. CBS (2016): Statistics Netherlands: Sharp increase in the share of renewable energy, available at: http://www.cbs.nl/en-GB/menu/themas/industrie-energie/publicaties/artikelen/archief/2015/ssterke-groei-aandeel-hernieuwbare-energie.htm.

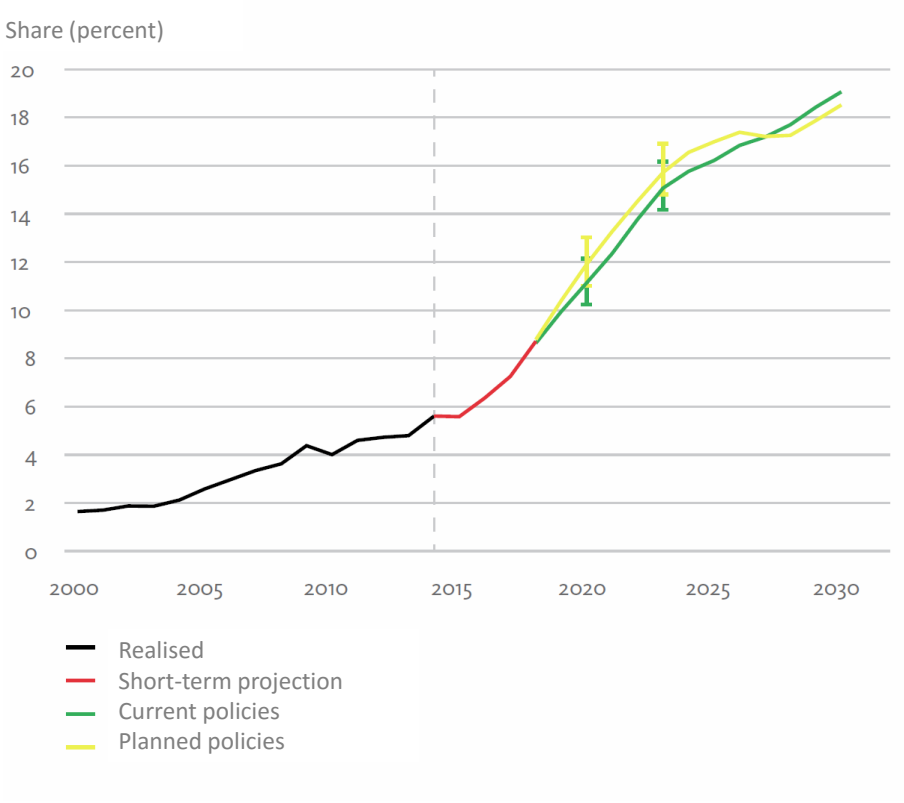

Figure 1: Expected RES share in final energy consumption in NL until 2030[4]

Country and market characteristics in Denmark

DK has a population of 5.7 million and annual electricity consumption of 30 TWh (ca. 1% of EU-28). With peak load of around 6.6 GW and interconnectors totalling 5.5 GW, it is well integrated in the European electricity system. DK is one of the leading countries in the world in terms of deployment of new renewable energies (non-hydro). The focus on renewable energy in DK started after the oil crisis in the 1970s, leading to the now existing ambitious climate and energy policies. In 1985, the Danish parliament decided not to build any nuclear power plants. Instead the country is today among the world leaders in wind power technology. Wind power supplied 39% of the Danish electricity consumption in 2014, while in the same year 43.5% of total energy consumption was covered by renewable energy (including biomass). Among the ambitious energy targets are:

- Energy consumption covered 100% by renewable sources in 2050
- Power and heat supply covered 100% by renewable sources in 2035
- Coal totally phased out by 2030

For the year 2020 the following targets can be expected to be achieved[5]:

[4] ECN (2015): Nationale Energieverkenning 2015, available at: http://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2015-nationale-energie-verkenning-2015_01712.pdf.

- 35% renewable energy in final energy consumption
- 50% of electricity consumption covered by wind power

The Danish electricity market can be characterised as a highly liberalised market. DK is part of Nordpool, with two price zones (DK1 and DK2). Market concentration in DK2 is one of the highest in the Nordic region[6]. Overall, the two largest players own 50% of total installed capacity (Dong Energy 39% and Vattenfall 11%, in 2013).

Several different instruments are used for the promotion of renewable energy, including feed-in tariffs, premiums and tax incentives[7]. Today, fixed premiums and sliding premium tariffs are the major schemes for new installations.[8] Auctions for renewable support are currently used for offshore and nearshore wind.

For onshore wind, the focus technology of this report, a premium payment is available. New onshore wind installations receive a premium of approx. 3.4 ct/kWh on top of the market price.[9] The sum of the market price and the premium is capped at 7.8 ct/kWh. Support is provided for a limited amount of electricity generation.

Before 2014, the total support for a turbine was determined such that 22,000 full load hours of the turbine's production were eligible for support payments. A 2MW turbine got its first 44,000 MWh of lifetime production supported whereas a 3MW turbine received support for its first 66,000 MWh of lifetime production. At a normal wind site in DK, however, the annual electricity production between the two types of turbines differs only slightly because wind speeds often prevent the turbines to work with full capacity. Thus, although the average production of 3MW turbines is only marginally larger than those of 2MW turbines, the 3MW turbines received considerably longer support. While 2MW turbines receive support for around 6.3 years, 3MW turbines were supported for ca. 8.9 years.

From January 2014, the total support duration is determined in a different way, now roughly depending only 30% on capacity (full load hours) and 70% on swept area. More precisely, the support comprises a fixed amount of 6.600 FLH but additionally 5.6 MWh are supported for every m^2 of the swept area. Unlike before 2014, this support policy benefits larger blades as the support increases with the size of the swept area.

While before 2014 each turbine, independent of its rotor size, received the same amount of support for 44,000 MWh, the support varies significantly with the new policy scheme after 2014. Turbines with a rotor diameter of 90m receive more support than before 2014, whereas turbines with a rotor diameter of 80m receive less support. The amount of full load hours eligible for support from the two example turbines (a Vestas 2MW turbine with 80m (V80) and 90m (V90) rotor diameter, respectively) is now 20,674 FLH and 24,412 FLH, respectively, as compared to 22,000 FLH before. For comparison, we calculate the new support duration for the two turbine types based on their average production in 2014 and 2015 in DK, where the V80 on average

[5] However, these interim targets have been removed by the current Danish government.
[6] http://www.nordicenergyregulators.org/wp-content/uploads/2014/06/Nordic-Market-Report-2014.pdf
[7] Kitzing et al. (2012): Renewable energy policies in Europe: Converging or diverging?, Energy Policy 51, 192-201, http://dx.doi.org/10.1016/j.enpol.2012.08.064.
[8] RES legal (2015): Denmark, available at: http://www.res-legal.eu/search-by-country/denmark/.
[9] Agora Energiewende (2016): A Snapshot of the Danish Energy Transition. Objectives, Markets, Grid, Support Schemes and Acceptance, available at: http://www.agora-energiewende.de/fileadmin/Projekte/2015/integration-variabler-erneuerbarer-energien-daenemark/Agora_Snapshot_of_the_Danish_Energy_Transition_WEB.pdf.

achieved 2,840 FLH and the V90 3,423 FLH[10]. Extrapolated to the whole period, the support duration can thus be estimated at 7.3 and 7.1 years, respectively.

In addition to the premium, all turbines receive a compensation of 0.25 ct/kWh to account for the average costs for balancing, which the turbine owners are responsible for and have to cover.

3 Potential design of the opened auction

The Dutch support scheme is organised as an auction and determines in a competitive process which power plants are granted access to the support scheme. At the same time it defines the support level for each plant (including electricity, gas and heat). Thus, the SDE+ scheme aims to incentivise the deployment of RES at the lowest possible cost, which is important to bear in mind when assessing this potentially opened auction.

Auction volume and timing in the SDE+

The SDE+ opens in a number of sequential phases each year. In 2015, 9 phases where opened for applications; phase 1 lasted from 31 March – 19 April, phase 2 from 20 April – 10 May, until Phase 9 (09 November – 30 December). In 2016 there will be two instead of one overall *round*, each including four *phases*. Each round will be open for one month (round 1 between 1 March – 28 March and round 2 between 30 August and 24 September). The budget for each round will be 3.5bn €, bringing the total budget for 2016 to 8bn €.

The auctioned volume does not include a limit on capacity but on the budget: when the budget (equalling the maximum required support payments for each auction round) is fully earmarked the auction closes.[11] There is one budget for all RES technologies (except for offshore wind, which is auctioned separately).

Auction procedure and pricing rule in national SDE+ and how to adapt tariffs for the opened auction

Although there is one budget for the total scheme, for each individual technology a so called “base amount” (the remuneration level) is defined based on LCOE calculations. They increase from one phase to the next and developers can apply for support in each phase according to their technology. The SDE+ is an ascending clock auction. For more expensive technologies, it can be worthwhile to wait with their application to maximise their support. However, the total budget of each round is capped and as soon as the entire budget has been

[10] Note that the difference in production is not only due to difference in rotor diameter but also due to differences in location, turbine age, number of turbines installed, etc.
[11] In the SDE+ an annual maximum support budget is defined, but the support is levy-financed by consumers.

awarded to projects the auction is closed for that round and project developers might not receive support at all[12]. On the day the budget cap is reached, the biddings are sorted on the base amount that was applied for. The Netherlands Enterprise Agency (RVO) grants the applications starting with the lowest base amount (see also figure 2 for a schematic illustration), until the budget cap is reached.

The SDE+ differentiates between technology categories (base amounts per technology), but it also includes a "free category" in each round. This category is open for all technologies that are able to produce at lower costs than the base amount that has been calculated for the specific technology[13]. This way, the free category gives developers the opportunity to access the SDE+ sooner as thus increase their chance to receive support. All projects, independent of the technology, can apply for subsidy in this free category and choose their own SDE+ base amount (which has to be below the base amount of that specific technology).

The projects are then merely selected on the basis of their offered base amount, no additional selection criteria are applied.

Illustration

I	II	III	IV	V/VI
7	8	9	11	13/15
Technology A (6.5)	Technology A (6.5)	Technology A (6.5)	Technology A (6.5)	Etc.
Free (7)	Technology B (7.5)	Technology B (7.5)	Technology B (7.5)	Etc.
	Free (8)	Technology C (8.5)	Technology C (8.5)	Etc.
		Free (9)	Technology D (9.5)	Etc.
			Free (11)	Etc.

Figure 2: Illustration of SDE+ (source: Dutch Ministry of Economy)

With the introduction of the "wind differentiation" in 2015, wind sites are subdivided into four wind speed categories (each municipality is ascribed one category). The 'Wind speed per municipality in NL (Dutch) chart shows the average wind speed per municipality in NL and distinguishes the following wind speed categories:

- ≥ 8.0 m/s
- ≥ 7.5 to < 8.0 m/s
- ≥ 7.0 to < 7.5 m/s
- < 7.0 m/s

[12] So far this happens frequently: only in 2014 there was still budget available in the last phase.
[13] Netherlands Enterprise Agency (2015): SDE+ 2015. Instructions on how to apply for a subsidy for the production of renewable energy, available at: http://english.rvo.nl/sites/default/files/2015/06/Brochure%20SDE%2B%202015.pdf.

A separate base amount is calculated per wind category and as a result the maximum amount for which one can apply for subsidy depends on the municipality in which the project is realised. The categories are based on a wind chart of the Royal Netherlands Meteorological Institute (KNMI). This approach has the effect of stimulating the realisation of wind farms in less windy locations, but its main purpose is to avoid windfall profits for installations on very good sites.[14]

For wind onshore the following rates applied in 2015 (ranging from 5.3 €ct/kWh for repowering to 11.4 €ct/kWh for "wind on lakes").

	Phase 1 From 31 March 9:00	Phase 2 From 20 April 17:00	Phase 3 From 11 May 17:00	Phase 4 From 1 June 17:00	Phase 5 From 22 June 17:00	Phase 6 From 31 August 17:00	Phase 7 From 21 September 17:00	Phase 8 From 12 October 17:00	Phase 9 From 9 November 17:00
Wind	**Base amount per phase (€ / kWh)**								
Onshore wind energy wind differentiation									
- ≥ 8.0 m/s	0.070	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074
- ≥ 7.5 en < 8.0 m/s	0.070	0.080	0.081	0.081	0.081	0.081	0.081	0.081	0.081
- ≥ 7.0 en < 7.5 m/s	0.070	0.080	0.086	0.086	0.086	0.086	0.086	0.086	0.086
- < 7.0 m/s	0.070	0.080	0.090	0.098	0.098	0.098	0.098	0.098	0.098
Onshore wind 1-for-1 replacement									
- ≥ 8.0 m/s	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053	0.053
- ≥ 7.5 en < 8.0 m/s	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058
- ≥ 7.0 en < 7.5 m/s	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
- < 7.0 m/s	0.070	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074
Wind on inter-connecting wind defences									
- ≥ 8.0 m/s	0.070	0.080	0.081	0.081	0.081	0.081	0.081	0.081	0.081
- ≥ 7.5 en < 8.0 m/s	0.070	0.080	0.088	0.088	0.088	0.088	0.088	0.088	0.088
- ≥ 7.0 en < 7.5 m/s	0.070	0.080	0.090	0.094	0.094	0.094	0.094	0.094	0.094
- < 7.0 m/s	0.070	0.080	0.090	0.100	0.107	0.107	0.107	0.107	0.107
Wind on lakes	0.070	0.080	0.090	0.100	0.110	0.114	0.114	0.114	0.114
Onshore wind energy transitional scheme (max. full load hours)	0.0875 (2,800)	0.100 (2,160)	0.1125 (1,840)	0.1125 (1,840)	0.1125 (1,840)	0.1125 (1,840)	0.1125 (1,840)	0.1125 (1,840)	0.1125 (1,840)

* Full load hours net P_{50} value.

** The amounts quoted in this row are after the application of the wind factor (1.25).

Figure 3: Rates for wind onshore applied in 2015

The tariffs published for the first SDE+ round for regular onshore wind installations (excluding "wind on inter-connecting wind defences" and "wind on lake") for 2016 are the following:

Table 1: Tariffs published for the first SDE+ round for regular onshore wind installations in 2016

Category (wind speeds)	Phase I (€/kWh)	Phase II (€/kWh)	Phase III (€/kWh)	Phase IV (€/kWh)
≥ 8.0 m/s	0.070			
≥ 7.5 to < 8.0 m/s	0.076			
≥ 7.0 to < 7.5 m/s	0.082			

[14] Interview with Dutch Ministry of economic affairs.

< 7.0 m/s		0.093		
Free category	0.090	0.110	0.130	0.150

Although the first round of the 2016 SDE+ will have four bidding phases (instead of 9 phases in 2015), wind onshore will only be eligible for support in the first two phases. Both SDE+ 2016 rounds will have the same structure and tariffs.

In addition to the base amounts related to the municipality, the eligible FLH are determined on the basis of estimated production output of the plant. In 2015 the bids needed to include an individual, independent wind assessment of each site and the maximum number of FLH per project was determined based on the wind report and the full load hours net P50 value. Since 2016, the installation-specific wind report is replaced by a published wind atlas (the so called "windviewer"), which seeks to provide average wind speeds "for each location in the Netherlands at any height from 20 to 160 meters" […], "based on the KNMI wind data for the period 2004-2013".[15] Maximum FLH are defined to effectively limit the amount of support payments. Moreover, maximum FLH incentivises RES-E producers to sell their electricity (and receive support) when prices are high (i.e. the market signal demand) and/or when prices are not negative.

Opened SDE+: How to adapt the base amounts for wind onshore installations from DK?

In order to open the SDE+ a new category in its support scheme that defines the "base amount" for wind onshore projects located in DK could be implemented. There are three options to determine the base amount for Danish onshore wind installations:

- Option 1: discard the LCOE logic and introduce "cost effective cooperation category"
- Option 2: maintain LCOE calculation and adapt all cost elements for Danish installations
- Option 3: maintain LCOE calculation but only adapt reduced number of cost elements

Option 1, discard the LCOE logic and introduce "cost effective cooperation category": The first option is a sort of "cost effective cooperation category", which reflects the aim of increasing the cost effectiveness of target achievement in NL and which defines base amounts per phase that NL perceives as justifiable and "efficient" in comparison to their domestic RES costs (thus, a category "Danish projects"). The base amount of onshore wind in the SDE+2016 ranges from 7 to 9.3 €ct/kWh, thus a base amount of <6.9 €ct/kWh might be considered acceptable from a Dutch perspective (excluding other relevant costs, such as transaction costs, etc.). Determining support levels by ignoring the LCOE components would discard the logic of the LCOE calculation underlying the current technology-specific base amounts in the SDE+.[16] However, this option

[15] RVO (2016): Windviewer, available at: http://www.rvo.nl/subsidies-regelingen/windviewer-sde. It is not entirely clear how detailed this wind atlas is and how it would be possible to provide wind speeds for all these heights, as most likely not all potential wind sites have been measures since 2004.

[16] Also the EC recommends in its guidance for RES support schemes to base administrative definitions of support levels on LCOE rather than other factors. European Commission (2013): European Commission guidance for the design of RES support schemes. Accompanying the document Communication from the Commission: Delivering the internal market in electricity and making the most of public intervention, available at: http://ec.europa.eu/energy/gas_electricity/doc/com_2013_public_intervention_swd04_en.pdf.

would avoid a number of follow-up problems that arise when determining the Danish onshore wind LCOE, as we will see below.

An additional variant of this option is to introduce a stronger competitive element in the auction for installations in DK: if in the Danish category installations could bid below the determined base amount (and thus transform this category into a ceiling price), there would not be a need to determine the LCOE anymore. For this approach to work properly, all Danish projects would have to be assessed at the end of each phase according to their requested base amount (in contrast to Dutch projects that access the respective base amount on a first-come-first-served basis within one SDE+ phase). However, as an interviewee of the Dutch Ministry of Economy stated, this option is not very likely to be acceptable, as discarding the fundamental LCOE logic of the SDE+ would undermine the coherence of the entire scheme. One of the main aims of the SDE+ is to avoid windfall profits, which would also not be ensured in this option.

Option 2, maintain LCOE calculation and adapt all cost elements for Danish installations: To maintain the LCOE-based calculation of support, RVO would introduce base amounts in the SDE+ specifically for onshore wind projects in DK and ECN would include into their annual recommendations the LCOE estimates for Danish onshore wind projects.[17] The question then is: which of the factors determining the support for onshore wind would have to be adapted for the specification of base amount for installations in DK? One option is to adapt as many factors as possible to the Danish LCOE components. This approach would aim for a level-playing field between onshore wind installations in NL and DK.

Among the relevant aspects to determine the LCOE of onshore wind are the expected output and the costs (including the required investment):[18]

Expected output: Following the recent changes in the SDE+ to categorise municipalities according to wind speeds to determine base amounts, also for DK Municipalities would have to be categorised. In addition, the "windviewer" determines the full load hours at P50 value for each site in NL. Such a "windviewer" already exists for DK, but the quality of the atlas would have to be assessed to see whether it meets the level of detail of the Dutch "windviewer". Alternatively, the expected output of a wind onshore plant could be established through an independent wind study for each installation (which might however not be accepted by NL because of the lack of transparency and the potential bias of such wind studies which are usually commissioned by the project developers themselves).

Costs: The SDE+ calculation tool uses as one input variable the required investment (total and per kW). To adapt this variable for the Danish installations, several elements would have to be taken into account:

- Costs for licensing (permitting procedures, respecting existing spatial planning processes, etc.)
- Personal and hardware costs
- Fixed and variable O&M costs
- Financing costs (including assumptions on the equity and debt share, the interest rate, the expected Return on investment (RoI), and the inflation rate)

[17] These categories could be extended to projects from other countries as well. However, due to the differing LCOE in each country, country and technology-specific categories would have to be introduced.
[18] See for the calculation of the LCOE the "OT model". ECN (2016): OT model, available at: https://www.ecn.nl/fileadmin/ecn/units/bs/SDE/SDE_2106/SDE2016_webversie.xlsx.

- Taxes (i.e. corporate taxes)
- As part of the cost elements also balancing costs would need to be considered. Both in NL and DK RES producers are balancing responsible (for which they can contract other parties). As seen above, in DK 0.25 €ct/kWh are included into the support payment as balancing costs. In NL the correction amount (i.e. the average wholesale market price) is adjusted to account for the average balancing costs.

A level-playing field be envisaged regarding the expected output of onshore wind plants and also regarding the costs underlying the LCOE calculation. There are several advantages of creating a level-playing field for installations in NL and DK:

- Rational economic considerations tell that a level-playing field ensures the most efficient allocation of plants and can lead to the best outcome in terms of lowering support costs.
- A level playing field might be perceived as a “fair” auction, supporting political acceptance in NL for the opened SDE+ because Dutch project developers would have no structural disadvantage compared to project developers with access to better Danish wind sites.
- The acceptance of auction procedures increases if auction participants perceive the auction to be fair.
- Preserving the logic of using wind sites of different qualities is one way of not only distributing awarded projects within NL but also between NL and DK (avoiding that budget is largely used for projects in DK).

However, there are several disadvantages of the attempt to create a level-playing field:

- Creating a level-playing field implies transaction costs. The entire process to define the technology-specific base amounts in the SDE+ would have to be replicated for the respective technology in DK (including the expected output and the cost elements). If the Dutch auctioned was opened up to other MS, the same procedure would have to be applied for all participating MS. However, these transaction costs have to be compared to the overall amount of support paid and then potentially do not appear to be significant anymore.
- Creating a level-playing field (and using sites with less potential in DK) would go against the logic of increasing the cost-effectiveness of the SDE+ by using high-potential sites outside the Dutch territory which cannot be found (or developed) in NL. At the same time, if the more expensive onshore wind sites in DK would still be cheaper than Dutch sites, it might still be acceptable for NL.

If Option 2 was chosen, one variant could be that the LCOE calculation is fully maintained, but implemented by the Danish Energy Agency in close cooperation with ECN, as the Danish authorities will have more detailed knowledge on many of the relevant elements of the LCOE for onshore wind in DK than the Dutch authorities. A basic requirement for this tariff to enter into the SDE+ would still be that the tariff is set lower than the lowest Dutch tariff for onshore wind.

Despite some transaction costs, this option might be preferable for NL as it keeps the LCOE logic and maintains the logic underlying the SDE+.[19]

Option 3, maintain LCOE calculation but only adapt reduced number of cost elements: An alternative is to maintain LCOE calculation but to reduce the number of elements adapted for the LCOE calculation. A pragmatic approach would allow independent, individual wind studies to replace the windviewer as well as the categorisation of municipalities. All cost elements would be kept as defined in the recommendation for the national SDE+ tariffs:

- This approach would take into account that fundamentally different site qualities need to be reflected in the tariffs.
- Transaction costs would be significantly reduced and potential show-stoppers (such as a Danish "windviewer") might be avoided.
- Constant cost assumptions for framework conditions (such as cost for licencing procedures), would trigger competition between the Dutch and the Danish administrative and regulatory environments. This in turn would create pressure in both countries to reduce administrative barriers and related costs to make sites in the respective country more competitive. This could result in a major benefit for Dutch project developers.

Stakeholder engagement for tariff-setting

In the current approach to determine the LCOE in NL, ECN and DNV GL draft recommendations for the technology-specific base amounts. These recommendations are discussed and potentially corrected in an extensive consultation process with stakeholders who provide their feedback on the cost elements.[20] Based on this consultation, ECN submits a final recommendation to the Ministry of Economics, which usually adopts them. If the SDE+ was opened for DK, this process could be fully replicated for the category "onshore wind from DK" (this would not be necessary, if the tariff-setting option 1 "discard the LCOE logic and introduce cost effective cooperation category" was chosen). Implementing a thorough stakeholder engagement for projects located in DK would help to set tariffs correctly (as the stakeholder engagement in NL equally seeks to avoid mistakes in the assumptions on costs). It would also help to communicate the opportunity to apply for the SDE+ more broadly among Danish stakeholders. This consultation might have to be supported by the Danish energy regulator addressing the right stakeholders and making the consultation public in DK. A disadvantage of this approach is that creates transaction costs for RVO in the NL.

An alternative would be to either limit the public consultation to an easy-to-use online submission platform for comments and to limit the promotion of this engagement possibility in DK to limit transaction costs.

[19] Interview with Dutch Ministry of economic affairs.
[20] See for instance ECN, DNK KEMA,TNO (2013): Draft advice base rates SDE+ 2014 for the market consultation, available at: https://www.ecn.nl/publicaties/ECN-E--13-027 and ECN, DNK KEMA,TNO (2013): Final advice base rates SDE+ 2014, available at: https://www.ecn.nl/publicaties/ECN-E--13-051.

Banking and repowering

Banking: As described above, in the SDE+ the maximum FLH are defined as an annual cap, but projects can make use of banking. First, “unused” FLH can be transferred to the next year to compensate for years with low power production. Second, as of 2016 power production that exceeded one annual FLH cap can also be statistically transferred to the next year (for a maximum of 25% of the FLH cap) to not miss out on subsidies in very strong years.[21]

In principle, banking should be allowed for installations from DK, as this would allow conditions for participating in the SDE+ comparable to installations in NL (and not allowing them to bank FLH would be a significant disadvantage).

One issue that might be of interest to DK is whether it would see a problem in accepting a relatively high total number of FLH supported, if compared to the Danish limit. Such a higher limit would imply that either wind installations would optimise towards FLHs (using smaller turbines) or they would act less reactive to market prices (e.g. not necessarily avoiding feed-in at time of negative prices). This might work against the idea behind the recent change of policy for onshore wind in Denmark (see description above).

Repowering: In 2015 repowering was introduced into the scheme: a category of “1-for-1 replacement” accounted for this via adapted base amounts. This category concerned the placing of a new turbine

- at the same location as the old turbine;
- where the capacity of the new turbine generates less than 1 MW extra when compared with the old turbine;
- where the old turbine, which is or was found at the same location at the moment of the application, was commissioned at least 10 years before.

However, as of 2016 the replacement of older turbines will no longer be a separate category and the conditions have been adapted: replacement will be only eligible for SDE+, if the

- replaced turbine has operated at least 15 years and
- the replacement is at least 1 MW larger than the old turbine.

Similar to banking also repowering should be allowed for installations in DK. Repowering would have advantages in this context:

- The realisation rate of repowering tends to be much higher than for newly built projects, which would increase the certainty for NL not to miss their 2020 RES target due to project failures.
- Repowering is potentially less costly because part of the costs might be avoidable in repowering such as site screening and, depending on the licensing and permitting requirements, some of the licensing and/ or permitting costs.
- Repowering could avoid potential NIMBY effects of additional onshore installations in DK.

[21] This does not apply to existing wind installations that are supported under “transitional scheme”. Here, the so called wind factor applies, which is an alternative to banking, covering the risk of the operator missing out on subsidy.

Premium calculation

Project developers whose bid gets selected in the SDE+ receive a sliding premium payment for a maximum amount of full load hours per year over a period of 15 years: the project developer has to sell the electricity directly to the Dutch power market, either at the power exchange (APX) or in over-the-counter contracts (OTC). The producer receives as support (the "SDE+ contribution") the difference between the "earnings for (fossil) energy"/"correction amount" (i.e. the yearly average day-ahead electricity price at the APX with corrections for profile- and balancing costs)[22] and the support level he or she applied for in the SDE+ rounds (the so called "base amount"). [23] Thus, the SDE+ uses the pay-as-bid pricing rule.[24]

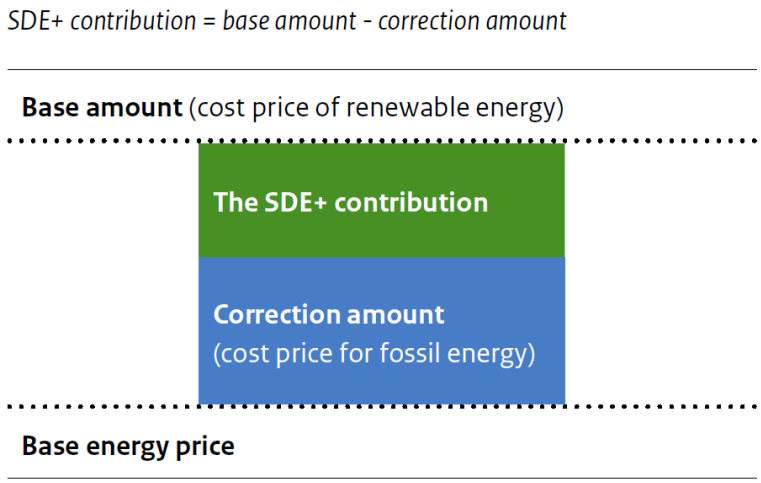

Figure 4 Illustration of SDE+ feed-in premium (Source: Netherlands Enterprise Agency 2015)

Opened SDE+: Which market price to use to calculate the premium payment?

In the opened SDE+, the project located in DK would receive the difference between the respective base amount and either the Danish or the Dutch average electricity price.[25]

Using the Danish average electricity price as the point of reference to determine the premium payment would follow the logic of market integration of RES (because RES-E producers would receive price signals of the price zone they operate in). One central issue is how the so called "correction amount" for DK would be

[22] ECN (2015): Definitieve correctiebedragen 2014, available at: ftp://ftp.ecn.nl/pub/www/library/report/2015/n15008.pdf.
[23] For wind projects that where advanced in 2015 (i.e. that had a draft embedding plan or a draft land-use plan submitted for consideration or the application for an integrated environmental permit submitted before 1 January 2015), in a transitional scheme a "wind factor" is included into the premium payment, taking into account the reduced market value of RES (as it usually feeds in when other RES also feed in, thereby structurally lowering its market value). Thus, the unweighted average market price is reduced by a factor, for instance, of 0.89 for onshore wind, resulting in higher premium payments compared to the actual average annual electricity price.
[24] As shown in Figure 4, the SDE+ uses a "base energy price" as being the lower limit for the "correction amount". This means that if the "correction amount" is lower than the "base energy price", the SDE+ will be calculated as follows: "base amount" – "base energy price". The difference between the "base energy price" and the "correction amount" are at the cost of the developer.
[25] If electricity import to the Netherlands is a requirement, also the Dutch electricity price could be chosen as the reference price (the "correction amount"). However, in terms of reacting to electricity demand in the most relevant price zone, the Danish electricity price might still be the preferable option.

determined. In the national SDE+ the annual average wholesale market price is used as a reference. This price is adjusted by a technology profile factor to account for the lower market value of variable RES. In addition, the balancing costs are deducted from the correction amount to compensate for them. As for the determination of the base amounts, also the determination of the correction amount would most likely happen in close cooperation with the Danish Energy Agency to determine the profile factor for onshore wind in DK and the cost of balancing.

When using the Danish market price as a reference point, any price difference between either of the two Danish price zones and the Dutch price zone would result in changed support costs for NL if compared to installations located in NL: lower average wholesale market price in DK than in NL would result in a higher overall amount of required support for an installation under the opened SDE+ and vice versa. This would run against the basic requirement of the opened SDE+ to lower support costs for NL. One option is that NL simply accepts this risk against the opportunities for cost savings related to this solution. However, political acceptance might be hard to obtain for this option, as the current public debate is rather sceptical of opening the SDE+ and to overcome this barrier, "guaranteed support cost savings" might be a minimum requirement for NL.

A possible solution is to require compensation payments from DK to offset potential extra costs due to wholesale price differences.[26] DK would only agree to this, if its local benefits of this cooperation are significant. But it seems likely that from a political acceptance viewpoint it would be difficult to convince the Danish parliament of direct payments to NL when benefits will be quite indirect. In contrast, in the unlikely case that NL saved additional support costs through a Danish power price that is higher compared to the Dutch price, it could make compensation payments to DK, making it potentially more acceptable for DK to give up some of their sites.

Using the Dutch average electricity price as the point of reference to determine the premium payment would avoid the dependency of support costs on the wholesale price in DK. Thereby it would also avoid the potential necessity of transfer payments, which are politically difficult to reason. However, if a RES project in DK receives a premium which is calculated according to the Dutch market price, it would receive an additional (unproductive) risk in terms of twofold market price risks (price risks in DK and NL) to which it may not be able to react fully adequately (i.e. market exposure might be different and respective financial swap contracts not always readily available).

An alternative is to grant projects from DK a fixed premium, while projects in NL still receive the sliding premium. This would pose a disadvantage for the Danish project developers in comparison to the Dutch RES installations as they would have to bear higher market price risks. But this option would have some crucial advantages:

- The price risk the Danish project developers are exposed to would only be related to the Danish wholesale price and not to both wholesale prices as in the option above.
- The potential requirement for transfer payments between DK and NL would be avoided.

[26] For the broader discussion on how to assess and distribute costs and benefits of RES cooperation also see the EU-project http://res-cooperation.eu/, especially Klessmann et al (2014): Cooperation between EU Member States under the RES Directive, available at: http://www.ecofys.com/files/files/ec-ecofys-tuvienna-2014-cooperation-member-states-res-directive.pdf.

- Danish project developers know and can handle the price risk as the Danish support scheme only has the fixed premium.
- NL would gain security regarding their support costs for installations supported in DK, as the paid subsidy would not depend on the market price anymore.

Exchange rate risk:

If projects in DK received support from the SDE+ the question is, which currency this support is paid in, i.e. in Euros or in DKK. If support is paid in DKK, the exchange rate risk is with the Dutch consumer, which might be politically difficult to accept for NL. If support is paid in Euros then the project in DK is exposed to an exchange rate risk: a changing exchange rate will lower or increase the project's return. However, the Danish krone is part of the ERM-II mechanism; its exchange rate is tied to within 2.25% of the Euro, so this issue is deemed to be a minor one.[27]

Prequalification criteria

In order to apply for the SDE+, onshore wind project developers in NL have to present several elements, including:

- Completed application form
- Required permits:
    - Environmental permit (Omgevingsvergunning);
    - Written permission of the owner of the location/land;
- A (technical) description of the installation/project;
- For projects with a budget claim >400 mio. EUR, a bank statement and a realisation contract (uitvoeringsovereenkomst) is required.
- Feasibility study: Since 2014 it is required to submit a feasibility study for projects that are larger than 0.5 MW, 500 kWp resp. 50 Nm³/hr. The feasibility study should contain the following elements:
    - Exploitation statement with:
        - A specification of the investment costs per (main) component of the production installation
        - A cost-benefit analysis of the installation
        - A profit & loss statement with expected returns on investment
    - Statement of the level of equity and financing:
        - Provide documents to substantiate equity (e.g. annual statement)
        - For projects with less than 20% equity: a letter of intent from a financing party stating capacity and willingness to finance the project
        - Calculations and projections of the expected production from wind: this aspect is replaced by the windviewer as of 2016, as explained above.

One issue that is particularly important in the SDE+ is the supervision of how the implementation of selected projects is progressing as this indicates whether a project will ultimately be implement or not. One year after being awarded support in the SDE+, the "Netherlands Enterprise Agency" (Rijksdienst voor Ondernemend Nederland / Netherlands Enterprise Agency, RVO), which is an independent administrative authority but part

[27] A currency in ERM II is allowed to float within a range of ±15% with respect to a central rate against the euro. In the case of the krone, Danmarks Nationalbank keeps the exchange rate within the narrower range of ± 2.25% against the central rate of EUR 1 = DKK 7.46038.

of the Ministry of Economic Affairs, checks upon the progress of the respective projects. Project developers have to prove that they have at least commissioned a firm to effectively build the installation, or at least the main part of the project. If he or she cannot provide such a proof, RVO speaks out an ultimatum after which penalties are applied.

Prequalification criteria in opened SDE+

In an opened SDE+ the question arises whether and how prequalification requirements would have to be adapted for installations located in DK. As a starting point, the Dutch Ministry would have to provide the application form in English and all other documents would have to be accepted in English to make the SDE+ accessible for projects from DK. The applicant from DK would have to have all licences that are required to build the respective installation in DK in place to meet the same prequalification criteria as in NL. One option is that Danish project developers send all required permits as part of their bid and RVO checks these permits. However, this will practically be difficult to implement because RVO is most likely not familiar with Danish licensing and permitting procedures in DK and familiarising RVO with the Danish context in detail will induce transactions costs. An alternative option is that the Danish Energy Agency issues an official confirmation for each applicant from DK, stating that all required permits are in place. This procedure would lower administrative transaction costs in NL, but would increase them in DK. This procedure would also potentially result in longer lead times for Danish project developers participating in this scheme compared to projects in DK participating in the Danish support scheme (because project developers would have to wait for additional proof of permits).

Also the process of proving project development progress might have to be replicated for projects in DK. Again, an official Danish authority (e.g. the Danish Energy Agency) could provide a confirmation of the project progress in DK.

An alternative to the material prequalification requirements is to implement stronger financial prequalification requirements specifically for those projects from DK (and remain them unchanged for projects in NL). This would ease the burden on either side of the public administration. However, more stringent financial prequalification requirements may have an effect on the variety of actors participating in this opened auction and also the effects of financial prequalification requirements on actual realisation rates are potentially weaker than those of material prequalification requirements.

Penalties

Since 2012, penalties are in place in the SDE+ for the non-realisation of projects within the required period (4 years for onshore wind). This is relevant for projects that claim > 400 mio. EUR of the budget (over their lifetime).These projects have to sign a contract for realisation with the executive agency of the Ministry of Economic affairs (AgencyNL) and have to present a bank statement. The fine is max. 2% of the budget claim of that project and decided by AgencyNL (or in Court in case of a dispute). The bank statement has to guarantee payment of this 2%. No projects have claimed more than 400 million EUR in 2012 and no information is available why such high limit was chosen. Taking the cost assumption of the SDE+ 2016 tariff

calculation tool as a basis (of 1290 €/kW), a wind farm would need to have a capacity of 310 MW to be subject to this penalty regulation.

For all other projects, developers will lose their subsidy if the installation is not constructed and connected to the grid within the given realisation period and/or when, within a year of the date of the decision, the order for the construction of the installation is not given. These projects cannot re-apply for SDE+ support within the next 3 years. However, in some cases it is possible to work around this exemption by "redefining" the project (e.g. by changing the capacity or the location) and apply again.

The penalties are in place to increase the realisation rate of submitted bids and to avoid unwanted strategic behaviour of auction participants. Apart from the penalties, also the prequalification requirements aim at increasing the realisations rate and the feasibility study introduced in 2014 and a stricter internal evaluation of the feasibility are seen as the two main components to significantly increase the realisation rate.

Penalties in opened SDE+

The penalty regulation should by and large remain as it is in place for projects located in NL. One question is whether changing the project size to be eligible for the SDE+ before the 3-year ban is lifted effectively incentivises a quick project realisation. Also, a project developer could sell its project to another (potentially related) company to reapply before the 3-year ban. These issues already occur in the national SDE+ but they might be intensified when Danish projects/companies are banned from the SDE+.

In case the material prequalification requirements are replaced by financial prequalification requirements for installations in DK, the penalties might be adapted as well, e.g. by replacing the 3-year ban with a financial penalty.

Related regulations

Auction volume in opened SDE+

If the SDE+ was opened for installations from DK, a concern on the Dutch part could be that a too large share of the SDE+ budget is awarded to projects located in DK. While the opened auction envisages that some installations are placed outside of the SDE+, a limitation of this effect might be crucial to improve political acceptability in NL for this step. Thus in a first round the SDE+ could open only a maximum of 10% of its budget for installations from DK (not necessarily implying that 10% will go to projects in DK). This share could potentially be increased when experience with the opening and the resulting effects have been gathered. This would in principle be a step away from the largely competitive and technology-neutral approach in the SDE+, but might nonetheless be required.

Proof of production

The effective support payments in the SDE+ are related to the provision of Guarantees of Origin (GO). In NL, CertiQ issues the GO certificates for electricity and heat. CertiQ is part of the electricity transmission company, TenneT TSO B.V. and provides RVO with information on the GO's provided by a specific project. Thus, the payment of the subsidy is based on these GOs.

For NL a similarity between both schemes of proofing power production would be preferable, as this would increase trust in the Danish verification scheme.

Balancing responsibilities

In NL the Electricity Act stipulates that all connected parties must arrange their own Balance Responsibility. The System Code states that connected parties can assign this responsibility to a legal entity recognised by TenneT as a Balance Responsible party. The cost balancing is included into the calculation of the “correction amount”.

In DK RES-E producers are also balancing responsible (and the cost of 0.25 ct/kWh for this is added to the tariff). Thus there is no need to adapt this regulation adjacent to the actual auction design. The only way that potentially differing balancing responsibilities should be taken into account is in terms of differing costs which have to be included into the tariff calculation.

Curtailment

Both NL and DK have priority dispatch for RES. In addition, in case of curtailment in both countries compensation is paid. So far, curtailment is seemingly not an issue in NL.[28] In terms of grid stability, the curtailment rules of the respective location need to apply. However, the open issue in this respect is who bears the cost of potential compensation payments for installations in DK. If in DK a wind power plant is curtailed, no electricity is produced that counts towards the 2020 RES target in NL. Moreover, curtailment is applied to preserve grid stability in the respective location. Therefore it seems reasonable if DK paid potential compensations for curtailment. Also, if DK would not have to pay compensation for curtailment for installations supported under the SDE+, it would have no financial incentive to not curtail these installations. Currently, this should not be a relevant issue as “there is hardly any curtailment of onshore wind energy”[29]. However, this might change in the mid-term when RES capacities increase in DK and more curtailment is required.

[28] Interview Dutch Ministry of Economy.
[29] Agora Energiewende (2016): A Snapshot of the Danish Energy Transition. Objectives, Markets, Grid, Support Schemes and Acceptance, available at: http://www.agora-energiewende.de/fileadmin/Projekte/2015/integration-variabler-erneuerbarer-energien-daenemark/Agora_Snapshot_of_the_Danish_Energy_Transition_WEB.pdf

4 Pros and cons of opening the SDE+

In the (anonymous) stakeholder interviews as well as in Dutch Parliament repeatedly arguments against the opening of the SDE+ have been brought forward. In this chapter we briefly explore these main arguments and explore pros and cons of such opening in general terms rather than with regard to the specific auction design.

Why make Dutch consumers pay for RES installations abroad? Shouldn't industrial benefits stay in NL rather than being transported abroad?

One argument against the opening of the SDE+ is that renewables deployment is a burden on Dutch consumers and therefore Dutch consumers should not pay for installations abroad, as they do not receive the benefits of the payment, such as positive industrial effects, energy security, and reduced air pollution.

One of the main premises of opening a national auction is that the Dutch support scheme would ultimately avoid cost for Dutch consumers (and lowering the levy for the SDE+). This happens because accessing better sites in DK (which are not available in NL) can decrease the cost of meeting the binding 2020 target. Thus, there is a cost to be borne by Dutch consumers, but this direct cost will be lower if compared to purely national 2020 RES target achievement. To estimate potential savings, current support levels in NL and DK need to be compared (with an example of 50MW capacity).

Table 2: Rough comparison of support payments under the current schemes for onshore wind in NL and DK

Comparison support costs NL / DK		
	NL	**DK**
Capacity (MW)	50	50
Base amount (2016) (€/kWh)	0.082	
Base energy price NL (€/kWh)	0.029	
Average price 2013 (€/kWh)	0.052	
Maximum premium payment (€/kWh)	0.053	0.034
Expected support payment	0.030	
FLH	42,000	24,000
Supported production (MWh)	2,100,000	1,200,000
Total maximum support (€)	111,300,000	40,800,000
Total estimated support (€)	63,000,000	40,800,000
Difference maximum support (€)	70,500,000	
Difference estimated support (€)	22,200,000	

As initially stated, the current support level in DK is a fixed premium of 3.4 €ct/kWh, with a cap at 7.8 €ct/kWh and an average limit of 24,000 FLH. Assuming that the full premium is paid due to low wholesale power prices, total support paid in DK can be 40.8 m€.

In NL support is paid as a floating premium (significantly reducing risks for the RES producer, thereby decreasing financing costs). The support level for onshore wind sites of ≥ 7.0 to < 7.5 m/s wind speed is 8.2 €ct/kWh in 2016. The ”base energy price” is the lower limit of the calculated average electricity price, thus support payments are limited to 5.3 €/kWh. If we assume as an example 2,800 annual FLH over the period of 15 years, 42,000 FLH are eligible for support under the SDE+, summing up to a maximum of 111.3 m€. As this will most likely not be the actual support payment, we estimate the expected support payment, using again a simplified assumption of constant annual Dutch electricity price at the level of 2013 of 0.052 €/kWh. This results in support payments of 63 m€ for this installation in NL.

This example does not take into account net value effects and also simplifies other assumptions (e.g. on electricity prices and correction factor), but it clearly shows that there is a relevant difference in current support payments between NL and DK at roughly around 20 m€ for a 50 MW wind onshore installation. This corresponds to approximately a third of the Dutch support payments, but of course depends on the specific plant that would be built in DK instead of NL (and the related base amount). This difference is the potential saving in direct support costs, if an installation was built in DK, counting towards the Dutch RES target.

Regarding industrial effects, usually Dutch industries profit from the SDE+ subsidies and job creation takes place in NL. IRENA estimates that for onshore wind 8.6 jobs (full time equivalents) are created for each newly installed MW and 0.2 during the O&M phase (OECD average).[30] This does not take net job effects into account, which IRENA estimates to be positive as well. The local content share in onshore wind projects is assumed to be higher compared to PV installations, but completely depends on industrial structures (e.g. supply chains) within a given country. If part of the installations supported by the SDE+ where built in DK instead of NL, these effects would take place in DK. However, already today international project developers can apply for subsidies under the SDE+ as long as the installation is based in NL. Similarly, project developers based in NL already apply for subsidies for installations in other countries, e.g. in DK. In other words, already today the industrial and economic benefits do not only take place where the installation is built.

Moreover, if the SDE+ was opened for installations in DK, there are several ways in which the Dutch industry could still profit from the subsidies while reducing the cost of the subsidy for Dutch consumers. Dutch project developers can develop projects in DK and then apply either for the Danish support or for the SDE+. By accessing better sites in DK, Dutch onshore wind producers can increase their competitiveness against other technologies in the SDE+. In addition, Dutch project developers could initiate joint ventures with Danish developers to reduce their transaction costs that occur by being active in two markets.

One additional way in which benefits for Dutch projects developers and the industry are triggered might be that if the opened support scheme induces competition between NL and DK to reduce administrative barriers and related costs (to make projects on their territory more competitive), Dutch project developers would

[30] IRENA (2013): Renewable Energy and Jobs, available at: http://www.irena.org/rejobs.pdf.

benefit from the resulting reform of licensing and permitting procedures. In turn, more efficient administration will make project development cheaper and thus lower the required support.

Ultimately, there are a number of cost and benefits related to the opening of the SDE+ (e.g. also foregone income taxes, avoided environmental impacts, etc.) and NL might want to consider these in detail to ensure that the SDE+ is opened in a way that benefits outweigh cost for the NL (i.e. consumers, project developers, industry, etc.).

What are the mid-term effects of these external installations on the Dutch energy transition? Are these installations not missing for the Dutch energy transition in the mid-term?

Another argument brought forward against the opening of the SDE+ is based on the premise that regardless of the EU 2020 RES target, NL seeks to implement a long-term energy transition. Any installation that is built outside of NL with Dutch support payments is then missing to drive the Dutch energy transition forward in the mid-term.

In the short term, this argument is correct. However, effects of RES installations will increasingly take place in a European context (i.e. physically integrated markets and more integrated market rules). As a result, higher RES shares in one MS (especially if well-integrated in the continental grid) will increasingly result in higher RES shares in the other MS, thereby driving forward the European energy transition. If NL opens the SDE+ in a first step for its neighbouring countries, effects on the Dutch energy system will be more likely.

Another option for NL would be to require a reciprocal opening of support schemes, i.e. DK opening its support scheme for installations located in NL. This way, not only RES installations in DK would be financed by NL but also vice versa. The overall new RES capacities might gradually shift from one country to another to the extent that this shift would increase the overall cost effectiveness of the support schemes of both countries. To make sure that finally both countries are better off than without the reciprocal cooperation, cost and benefits will have to be balanced between both countries (e.g. through transfer payments after taking into account the netting of costs and benefits[31]).

If RES producers can access either of two support schemes (the Dutch or the Danish), is the result a “race for subsidies”?

A third argument brought forward against the opening of the SDE+ is related to installations located in DK: if a RES producer can choose between two subsidy schemes, he will pick the more lucrative one (“cherry picking”), either the SDE+ or that of DK. First, this would lead to windfall profits for RES producers. Second,

[31] On transfer payments also see the EU-project http://res-cooperation.eu/, especially Klessmann et al (2014): Cooperation between EU Member States under the RES Directive, available at: http://www.ecofys.com/files/files/ec-ecofys-tuvienna-2014-cooperation-member-states-res-directive.pdf.

DK and NL would then be in competition for who offers the best (highest) subsidies to ensure that RES plants use their support scheme and that their RES production counts towards their respective national RES target. This effect takes place if two support schemes are competing that determine support levels administratively.

However, if one support scheme uses administratively defined support levels and the other one determines support level through competitive bidding, then the administratively fixed support level will define the lower price limit in the auction. In this case the 7.8€ct/kWh (for approx. 25,000 FLH over 20 years) offered in DK would compete against the tariffs for onshore wind in NL of 7-9.3 €ct/kWh (for annual FLH over 15 years) and Danish projects would only opt for the SDE+, if support under the SDE+ was higher. But the Dutch scheme is a competitive bidding scheme and only those RES projects from DK would be selected that ensure support cost-savings for Dutch consumers compared to domestic Dutch installations. There might still be an issue with perceived windfall profits, but the main aim of saving support costs for NL would in principle be preserved.

The preferable option is to have two competitive bidding schemes in place, as this would largely avoid this specific type of interaction between support schemes. If both schemes are competitive (and functioning well), RES producers should be incentivised to reveal their actual support requirements. Also the EEAG define auctions as the standard procedure to define tariffs and it is very likely that those will be implemented in DK as well.[32] In addition, one might argue that competition between countries and their support schemes is already taking place in the context of internationally operating investors. If two support schemes exist in parallel on the same territory, this type of unwanted competition will just be a bit more visible and direct.

Why would DK accept additional installations supported by NL?

On part of DK, one argument against allowing wind onshore installations that are support by the SDE+ on Danish territory is that DK already has a very high share of RES and adding more wind onshore installations would increase the requirement for grid integration efforts and related costs. However, the Danish TSO Energinet.dk has recently stated that another 13GW of onshore wind energy can be installed until 2030 at socio-economic cost lower than offshore wind. There will be costs for grid integration, but given DK's long-term target of 100% RES, this integration costs will occur in any case.

In addition, there is increasing hesitance to accept additional RES plants (related to the "not in my backyard"/NIMBY-problem).[33] In this context, also competition for sites is an important factor as many sites have already been occupied for RES by investors and land owners. There is a preoccupation that if another support scheme triggers additional RES investments in DK, competition for sites will even increase. This problem could partially be addressed, if support from the SDE+ was targeting repowering only, which has a large potential in DK, according to the Danish Energy Agency. If the SDE+ only supported repowering, no additional sites would have to be used for installations under the SDE+ in DK. In addition, repowering

[32] European Commission (2014): Communication from the Commission — Guidelines on State aid for environmental protection and energy 2014-2020, available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628%2801%29&from=EN.
[33] Interview Danish Energy Agency.

potentially provides more cost savings for the SDE+ than new plants. On the other hand, these repowering options would also not be available for DK anymore.

Moreover, one concern on the Danish side could be that DK would give up good wind sites, which it could then not use for its own target achievement anymore. However, DK will easily meet its 2020 target whereas NL will have great difficulties to do so. Much more than the current target achievement, the Danish power system faces the challenge of the final transformation towards a low carbon power sector. Thus the immediate concerns rather revolve around issues such as energy security and RES integration rather than target achievement. Moreover, any wind onshore installation that would be built under the SDE+ would finance and help the Danish energy transition in the long-term. This would mostly be true for additional wind onshore installations, that then again would face the NIMBY-barrier.

5 Preliminary expectations on the performance of the auction based on assessment criteria

This chapter very briefly assesses the effects of changing from a national to an opened SDE+, it does evaluate the performance of the SDE+ as such.

Policy effectiveness: The implementation rate of projects in DK would presumably be similar to those in the national SDE+ in case the material prequalification requirements are kept in place. In case these are replaced by financial prequalification requirements for projects in DK, the realisation rate might decrease. In any case, with a potential limitation of the SDE+ budget for installations in DK, the overall effect would be limited at first.

Static efficiency/Cost effectiveness: The SDE+ is a technology neutral auction, thus it has generally speaking a high static efficiency because it support the cheapest technology options. Opening the SDE+ would further improve the static efficiency since more resourceful onshore wind sites would be available.

Dynamic efficiency: The SDE+ explicitly does not aim for dynamic efficiency, but for the cheapest options to achieve the 2020 RES target. By opening up the support scheme, possible technology learning effects due to limited site availability in NL might be offset. Moreover, more expensive technologies currently receiving support under the SDE+ could be pushed out of the system (with consequences for the Dutch industry, etc.).

Actor variety and social acceptability: The large majority of parties that apply for SDE+ are (small) SMEs (>80%), followed by non-profit organisations (municipalities, sport associations, water boards, schools etc.). A

small percentage of applicants may be grouped as larger (multi-national) companies and utilities. In the table below the shares of participant types are presented.

Table 3: Shares of participant types in the SDE+ rounds in 2011 - 2015

	SME	Large/multi-national	Utility	Non-profit, public authority, municipality etc.	Unknown
2011	79%	1%	0%	20%	
2012	85%	0%	2%	14%	
2013	81%	2%	1%	15%	
2014*	67%	<1%	2%	12%	18%
2015	70%	2%	8%	11%	9%

* Estimated based on overviews, Source: Ecofys 2015 (status 01/2015) on the basis of RVO.nl[34].

The level of competition may be typified as healthy, with different participants each year. The accessibility of the scheme for smaller companies and non-profit organisations is good.

If the SDE+ was opened for installations from DK, potentially larger project developers from DK might enter into the scheme. Especially the requirement to know the market and operational context in DK and the functioning of the Dutch support scheme at the same time would potentially attract already internationally active actors rather than small local actors.

Compatibility with market principles and integration: The suggested scheme is in principle compatible with market principles and market integration as the SDE+ determines support levels on a competitive basis and because the subsidies are paid on top of revenues generated from direct marketing of the produced energy. In addition, allowing projects from other Member States into the SDE+ can be seen as a further step towards market compatibility because the national limitation of access to support is opened up for the first time.

The compatibility with market principles and integration of the onshore wind plants also depend on how the premium payment is calculated. If the Danish market price is used, installations in DK might react to market signals. If the Dutch market price is used to calculate premiums for installations that sell their electricity in one of the Danish price zones, the RES producers are faced with the additional price risk of the Dutch APX. This price risk would not be productive, as the RES-E producer cannot react to it.

[34] RVO (2015): SDE+ 2014. Positieve beschikkingen op 01-01-2015, available at: http://www.rvo.nl/sites/default/files/2014/07/SDE%2B%202014%20Positieve%20beschikkingen.pdf.

Distributional effects & minimisation of support costs: The opening of the SDE+ would result in decreased total support payments for energy from RES as better onshore wind sites would be available to the SDE+, potentially receiving lower support levels. However, this effect depends on which electricity price is used to calculate the premium payment: if the Danish price is used, any difference to Dutch electricity prices would result in changed support costs as the difference to the support level changes. This could further decrease support costs (if the Danish electricity price is higher) and could increase support costs if the Danish electricity price is lower than the Dutch electricity price. Transfer payments from DK to NL might offset the potentially negative effects on support costs.

It would also result in a shift of support payments from RES installations in NL to those in DK. Thereby the industrial effects would also take place in DK rather than in NL. However, Dutch project developers could increasingly become active in DK and make use of these sites. Against the background of most SDE+ participants being small to medium sized actors, this is questionable though.

6 Conclusions

In this report we explored design options to open the Dutch auctions (SDE+) to onshore wind installations in DK. Regarding the tariff setting in the SDE+, all three presented options show advantages and disadvantages. Replicating the existing LCOE logic as precisely as possible, but defining base and correction mounts in close cooperation with Danish authorities (e.g. the Danish Energy Agency) seems to be preferable. Regarding the different options for the premium calculation, using the Danish price to calculate the premium payments combined with transfer payments from DK to NL might be one suitable option. Introducing in the SDE+ a fixed premium for installations in DK is suitable to avoiding transfer payments between the two MS and provides security regarding the budget for support payments from NL to installations in DK (and installations in DK are used to the risks related to fixed premiums).

The prequalification criteria may be kept similar for Danish projects that apply for SDE+ subsidies, but a statement of a Danish authority for each plant that all required permits are in place would be beneficial to lower transaction costs for the Dutch authorities. Equally, penalties could in principle remain the same.

At first, NL might want to limit the share of the maximum SDE+ budget that can be awarded to projects in DK in a pilot phase to collect first experiences with the scheme and to improve public acceptance in NL.

Regarding the more general pros and cons of opening the SDE+, which are more related to the cooperation part of the opened support scheme rather than to auctions as such and which have been publicly discussed, an in-depth cost-benefit analysis would help to shed light on the complex effects of such a cooperation. As we have seen, consumers in NL can potentially profit from significant support cost savings. Part of the positive industrial effects would be transferred to DK (although also project developers from NL could make use of Danish sites). An increasingly integrated European electricity market will in the mid-to-long-term result in the effect that any additional RES installation placed in nearby Member States contributes to the energy transition of the MS paying the support. The potential “race for subsidies” in the context of two simultaneously existing

support schemes can be avoided by implementing competitive schemes in both countries. However, this aspect would have to be explored more in-depth to ensure that benefits for both cooperating countries outweigh their costs.

On part of DK, the concern that DK already has a very high share of RES, the Danish TSO Energinet.dk seemingly is less concerned about the possibilities to integrate additional RES capacities. The NIMBY-problem could be eased, if support from the SDE+ was targeting repowering only, which has a large potential in DK.

The preliminary expectations on the performance of the opened scheme show a positive tendency. Regarding policy effectiveness, the implementation rate of projects in DK would presumably be similar to those in the national SDE+ in case the material prequalification requirements are kept in place. For static efficiency and cost effectiveness, opening the SDE+ would further improve its performance because more resourceful onshore wind sites would be available, potentially lowering support costs in the SDE+ to a significant extent.

Regarding dynamic efficiency, the SDE+ explicitly does not aim for dynamic efficiency, but for the cheapest options to achieve the 2020 RES target. As regards actor variety and social acceptability, the large majority of parties that apply for SDE+ are (small) SMEs (>80%), followed by non-profit organisations (municipalities, sport associations, water boards, schools etc.). If the SDE+ was opened for installations from DK, potentially larger project developers from DK might enter into the scheme. Especially the requirement to know the market and operational context in DK and the functioning of the Dutch support scheme at the same time will attract already internationally active actors rather than small local actors.

Compatibility with market principles and integration would be improved because allowing projects from other Member States into the SDE+ can be seen as a further step because the national limitation of access to support would be opened up for the first time (apart from Norway and Sweden).

As for distributional effects & minimisation of support costs, the opening of the SDE+ would result in decreased total support payments for energy from RES as better onshore wind sites would be available to the SDE+. It would also result in a shift of support payments from RES installations in NL to those in DK. Thereby the industrial effects would also take place in DK rather than in NL. However, Dutch project developers could increasingly become active in DK and make use of these sites.

Overall, the report shows that it is feasible to open an auction to another MS; several design elements can be adapted while keeping the overall design of the SDE+ in place. In case this opening was implemented, several of the design options would have to be decided on (especially those that depend on the respective preferences of the Member State) and some design options and its effects would have to be further explored (e.g. if changing from material to financial prequalification requirements).

Bibliography

Agora Energiewende (2016): A Snapshot of the Danish Energy Transition. Objectives, Markets, Grid, Support Schemes and Acceptance, available at: http://www.agora-energiewende.de/fileadmin/Projekte/2015/integration-variabler-erneuerbarer-energien-daenemark/Agora_Snapshot_of_the_Danish_Energy_Transition_WEB.pdf.

CBS (2016): Statistics Netherlands: Sharp increase in the share of renewable energy, available at: http://www.cbs.nl/en-GB/menu/themas/industrie-energie/publicaties/artikelen/archief/2015/ssterke-groei-aandeel-hernieuwbare-energie.htm.

ECN (2015): Definitieve correctiebedragen 2014, available at: ftp://ftp.ecn.nl/pub/www/library/report/2015/n15008.pdf.

ECN (2015): Nationale Energieverkenning 2015, available at: http://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2015-nationale-energie-verkenning-2015_01712.pdf.

ECN (2016): OT model, available at: https://www.ecn.nl/fileadmin/ecn/units/bs/SDE/SDE_2106/SDE2016_webversie.xlsx.

ECN, DNK KEMA,TNO (2013a): Draft advice base rates SDE+ 2014 for the market consultation, available at: https://www.ecn.nl/publicaties/ECN-E--13-027.

ECN, DNK KEMA,TNO (2013b): Final advice base rates SDE+ 2014, available at: https://www.ecn.nl/publicaties/ECN-E--13-051.

Energinet.dk (2015): Analyse af potentialet for landvind i Danmark i 2030, available at: https://www.energinet.dk/SiteCollectionDocuments/Danske%20dokumenter/Klimaogmiljo/Potentialet%20for%20landvind%20i%20Danmark%20i%202030.pdf.

European Commission (2013): European Commission guidance for the design of RES support schemes. Accompanying the document Communication from the Commission: Delivering the internal market in electricity and making the most of public intervention, available at: http://ec.europa.eu/energy/gas_electricity/doc/com_2013_public_intervention_swd04_en.pdf.

European Commission (2014): Communication from the Commission — Guidelines on State aid for environmental protection and energy 2014-2020, available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628%2801%29&from=EN.

IRENA (2013): Renewable Energy and Jobs, available at: http://www.irena.org/rejobs.pdf.

Kitzing et al. (2012): Renewable energy policies in Europe: Converging or diverging?, Energy Policy 51, 192-201, http://dx.doi.org/10.1016/j.enpol.2012.08.064

Klessmann et al 2014, Cooperation between EU Member States under the RES Directive, available at: http://www.ecofys.com/files/files/ec-ecofys-tuvienna-2014-cooperation-member-states-res-directive.pdf.

Netherlands Enterprise Agency (2015): SDE+ 2015. Instructions on how to apply for a subsidy for the production of renewable energy, available at: http://english.rvo.nl/sites/default/files/2015/06/Brochure%20SDE%2B%202015.pdf.

Nordic Energy Regulators (2014): Nordic Market Report, available at: http://www.nordicenergyregulators.org/wp-content/uploads/2014/06/Nordic-Market-Report-2014.pdf.

RES legal (2015): Denmark, available at: http://www.res-legal.eu/search-by-country/denmark/.

RVO (2015): SDE+ 2014. Positieve beschikkingen op 01-01-2015, available at: http://www.rvo.nl/sites/default/files/2014/07/SDE%2B%202014%20Positieve%20beschikkingen.pdf.

RVO (2016): Windviewer, available at: http://www.rvo.nl/subsidies-regelingen/windviewer-sde.